

Title: Harvey Potter's Fields

Brief Overview:

This unit involves a collection of activities designed to familiarize students with the concepts of area and perimeter. Students will use geoboards, yardsticks, rulers, models, and grids. The unit contains a math-literature link using the book Harvey Potter's Balloon Farm, by Jerdine Nolen. The children will be expected to communicate their findings mathematically, verbally, and in written form.

Links to NCTM Standards:

- **Mathematics as Problem Solving**
Students will demonstrate their ability to solve problems in mathematics including problems with open-ended answers, problems which are solved in a cooperative atmosphere, and problems which will be solved with the use of technology.
- **Mathematics as Communication**
Students will demonstrate their ability to communicate mathematically. They will read, write, and discuss mathematics with language and the signs, symbols, and terms of the discipline.
- **Mathematics as Reasoning**
Students will demonstrate their ability to reason mathematically. They will make conjectures, gather evidence, and build arguments.
- **Connections**
Students will demonstrate their ability to connect mathematics topics within the discipline and with other disciplines.
- **Number Concepts & Relationships**
Students will demonstrate their ability to apply estimation strategies in computation, in measurement, and in problem solving. They will determine reasonableness of solutions. Students will demonstrate their ability to solve problems using arithmetic operations.
- **Geometry and Spatial Sense**
Students will demonstrate their knowledge of area and perimeter. They will also demonstrate their ability to recreate different geometric shapes.
- **Measurement**
Students will demonstrate and apply concepts of measurement using non-standard and standard customary units. They will estimate and verify measurements. They will apply measurement to interdisciplinary and real-world problem solving situations.

- **Statistics**

Students will demonstrate their ability to collect, organize, and display data and will interpret information obtained from displays.

Grade/Level:

Grades 3-4

Duration/Length:

This learning unit takes approximately 4 sixty minute periods to complete.
Day 5 remains open for completion of lessons and extension activities.

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

- Constructing bar graphs
- Measuring to the nearest foot, using a ruler and a yardstick
- Converting feet into yards
- Estimating and calculating areas and perimeters of regular shapes.
- Understanding scale
- Multiplying
- Calculating money values
- Completing tables and charts
- Verifying work on calculator
- Writing to express personal ideas and writing to inform

Objectives:

Students will:

- analyze data.
- calculate area and perimeter using geoboards.
- construct and label shapes on dot paper in order to calculate area and perimeter.
- use yardsticks, rulers and models to measure specified shapes.
- calculate cost.
- convert measurement units and apply to problems.
- compare measurements using scale.
- provide written and oral feedback.
- work individually, in cooperative pairs and in groups.

Materials/Resources/Printed Materials:

Day 1:

- Harvey Potter's Balloon Farm, by Jerdine Nolen
- Student journal
- Animal sheet (multiple copies-assorted numbers) TR1
- Plastic baggies
- Crayons
- Barn data sheet SR1
- Graph paper SR2

Day 2:

- Geoboards (one per child and one transparent)
- Geobands
- Overheads with definitions of area and perimeter TR2 & TR3
- Dot paper (as needed-for groups) SR3
- Student journals

Day 3:

Outside activity:

- Yardstick
- Ruler
- Clipboard/pencil
- One copy of area and perimeter table SR4
- 6 models of square yard cut from tagboard

Classroom activity:

- One copy of field shapes per group SR5
- Scissors
- Copy of area & perimeter table per child SR4 (also used for outside activity)
- Extension activity with ruler SR6
- Calculator

Day 4:

- Completed SR5 (area and perimeter table from Day 3)
- Copy of best buy sheet per group SR7
- Student journals

Development/Procedures:

Day 1:

- Brainstorming activity: have the students generate as many ideas as possible about farms.
- Record ideas in web form.
- Distribute student journals and assign writing task entitled, “If you had a farm, what would you grow?” Remind students that this writing piece will include their personal ideas.
- Present and read Harvey Potter’s Balloon Farm. Tell the students that this weeks math activities will focus on different points concerning Harvey Potter’s fields.
- Explain that Mr. Potter always wants to know what kinds of balloons his fields produce. The students will determine balloon yield with the following data analysis activity. Distribute baggies with a different number of animal shapes in each bag. As the children are sorting the animals into groups, distribute the data sheets and graph paper. Tell the students to record their counts on the data sheet and then construct a bar graph which reflects their findings. Upon completion of the graphs, allow several students to explain their graphs and display all graphs somewhere in the room.
- Preview tomorrow’s lesson by telling the students they will be exploring area and perimeter through the use of geoboards and dot paper.

Teacher Tips for the Day: When preparing the baggies of animal shapes, keep in mind the size of your graph paper. Make sure you place different combinations of animals in each baggie, so that all the graphs are different.

Day 2:

- Open with a review of yesterday’s lesson. Query the students to determine their background of area and perimeter. Present overlays showing area and perimeter to extend their knowledge.
- Distribute geoboards and geobands to each student. Have students copy a simple rectangular shape shown on the teacher’s geoboard. Review how to count units of area and perimeter. Give special attention to using the term “square units” when discussing area. Provide several models and have the students copy and determine the area and perimeter of each.
- Once students are comfortable with this task, give them a specified perimeter and ask them to create a shape with that perimeter. Provide several different perimeters. Repeat procedure for area.
- Distribute and explain dot paper (SR3). Students will determine the perimeter and area of the six given shapes. On the bottom section of the dot paper, students will create fields with the given measurements. **On both sections, children must label the areas and perimeters directly on the dot paper.**
- Collect materials and distribute student journals. Have students share in their groups yesterday’s entries, “What would you grow?”

- Preview tomorrow's lesson by telling the students that they will be going outside with measurement tools.

Teacher Tips for the Day: As the children discuss area and perimeter, make sure they are saying "p=__units and a=__square units."

Some students may need to see a square unit on the geoboard. You may need to cut square units from tagboard for use on the overhead and for children who need an additional visual cue.

Suggestions for lettered half of dot paper: write possible areas and perimeters on the board, overhead, or say them orally. Suggest that they make different shapes than those on the top of the paper.

Day 3:

- Open with a review of yesterday's lesson. Explain that today's activities will include everyone, but not everyone will do every job. Outline for the students how they will be human pegs on imaginary geoboards. They will then determine the perimeters of fields that Harvey Potter might plant. Students will use both rulers and yardsticks. They will also use the square yard units to determine the area of the fields.
- **Teacher Instructions:** Once outside, count off the number of students you desire to be pegs. Arrange them in a regular rectangle to begin. Have the next two students act as the measurers. Give one student a yardstick and one a ruler. Discussion should begin on which tool is better to use. The next child in line will record the perimeter **with labels** on the table (SR4). For area, use the square yard models to determine the answer. Record on the table (SR4). Repeat activity creating four more shapes of your choice that are manageable for the students to measure. Continue to record results on SR4.
- Return to the classroom and divide the class into cooperative groups of five students. Discuss the use of scale when talking about large spaces. Then distribute one copy of the field shapes on SR5 or SR6 to each group (see Teacher Tips). Have each student cut out one shape each. **Tell students to estimate perimeter and area for all fields prior to determining the actual measurements.** Tell the students to determine both the area and perimeter of each shape and record findings on the area and perimeter table (SR4). **Collect tables at the end of the period.**
- Preview tomorrow's lesson by telling students that Harvey Potter has had an unwelcome visitor on his farm. Their task tomorrow will be to determine the cost of fencing to protect Farmer Potter's fields.

Teacher Tips for the Day: Be sure to make alternate plans for the outside activity in case of inclement weather.

While outside, you may need several students to act as pegs in order to accurately measure the perimeter and area. You may also want to have the students hold a piece of string between them to provide a guide for measuring.

Depending on the ability of your students, two sheets of fields have been provided, one for counting nonstandard units and one for measuring with standard $\frac{1}{2}$ " units.

Day 4:

- Open with a review of yesterday's lesson. Explain that we are going to be helping Farmer Potter protect his fields from unwanted guests (if time allows, students could draw a picture of how the unwanted guest may look). They will need to purchase fencing to go around the fields they worked with yesterday-SR4. Present an example on the board asking if fencing costs \$1.00 a yard, how much would 40 yards of fencing cost? Model this problem with the students using the information for Field 1. Repeat with as many fields as appropriate for the level of your students.
- Divide the class into pairs. Distribute Best Buy Sheet (SR5). Assign one field to each pair of students. **Instruct students that all work must be shown.** Make sure they predict which would be the best buy before they calculate. Students may use calculators to verify their work. **Collect these sheets at the end of the lesson.** Pass out the student journals and assign the following writing task: Which store offered the best buy on fencing? How did you determine which store had the best deal? How might pricing influence a buyer?

Teacher Tip for the Day: Depending on the level of your students, you may change the prices on the "Best Buy" sheet. Be aware that this activity involves multi-step problems and may require teacher direction.

Performance Assessment:

These rubrics are provided as suggestions. Teachers may adapt them to meet their objectives.

Day 1:

Use this rubric to score the graph:

- | | |
|---|---|
| 2 | Had all elements of a graph (title, labels, axes, intervals) and data was reported correctly. |
| 1 | Had all elements of a graph, data was not reported correctly. |
| 0 | Elements left out, data was not reported correctly. |

Day 2:

Use this rubric to score the dot paper work:

- | | |
|---|--|
| 2 | All shapes are drawn and correct areas and perimeters are labeled. |
| 1 | Six of the shapes are completed correctly. |
| 0 | Five or less of the shapes are completed correctly. |

Day 3:

Use this rubric to score the area and perimeter table:

- | | |
|---|---|
| 2 | Perimeter and area are calculated correctly for all five fields. |
| 1 | Perimeter and area are calculated correctly for three fields. |
| 0 | Perimeter and area are calculated correctly for two or less fields. |

Day 4:

Use this rubric to score the writing:

- | | |
|---|---|
| 3 | All parts of questions were answered completely. Student referenced work from “Best Buy” activity to support answers. Correct spelling, grammar, sentence structure and punctuation were used throughout. |
| 2 | All parts of questions were answered, but not in a complete or well-developed form. Student did not use “Best Buy” activity to support answers. Some errors in spelling, grammar, sentence structure and punctuation. |
| 1 | All parts of questions were not answered and were not supported by the “Best Buy” activity. Many errors in spelling, grammar, sentence structure and punctuation. |
| 0 | No attempt was made to answer questions. |

Extension/Follow Up:

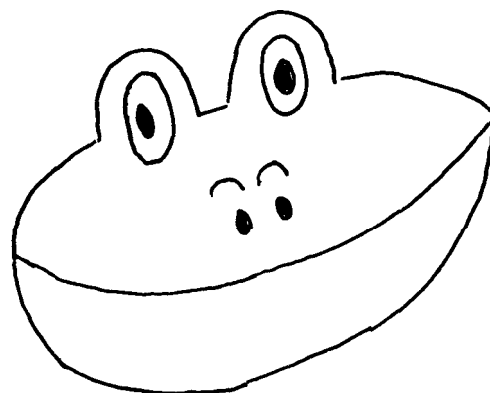
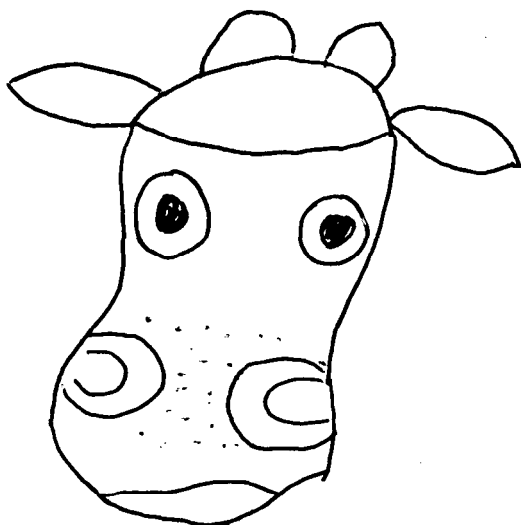
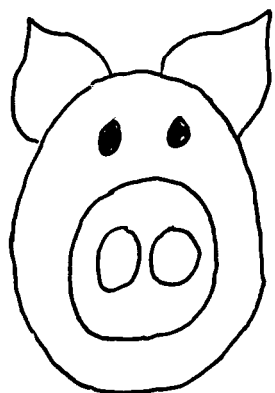
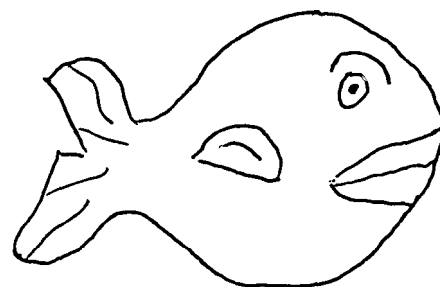
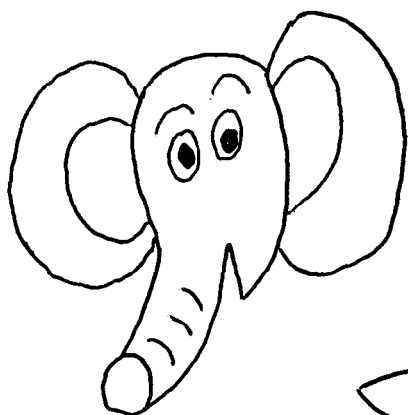
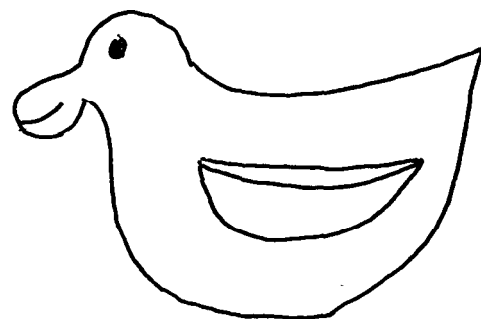
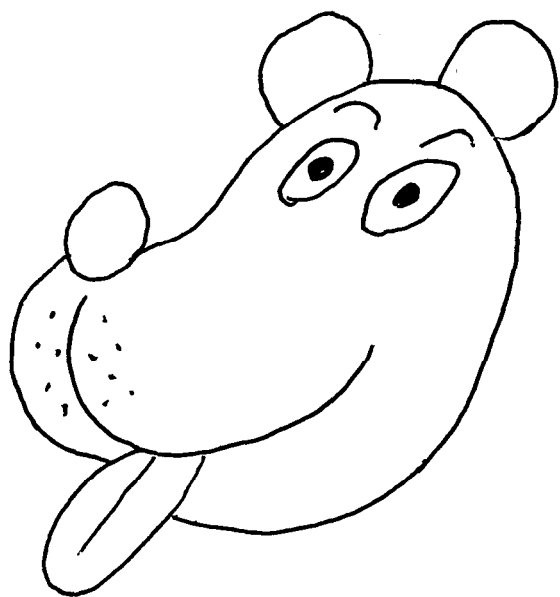
- Create different types of graphs.
- Create graphs about the colors of the balloons.
- Calculate yield of fields based on area.
- Calculate the probability of choosing different balloons.
- Act out the story.
- Take a field trip to a farm.
- Plant a garden for the school and build a fence around it.
- Take a field trip to a hardware store.
- Invent a conjure stick and tell what powers it would have.
- Build a model of a farm using any math manipulatives.

Authors:

Grace Murdock
Beaver Run Elementary
Wicomico County, MD

Michele Repass
Hugh Mercer Elementary
Fredericksburg, VA

TR1

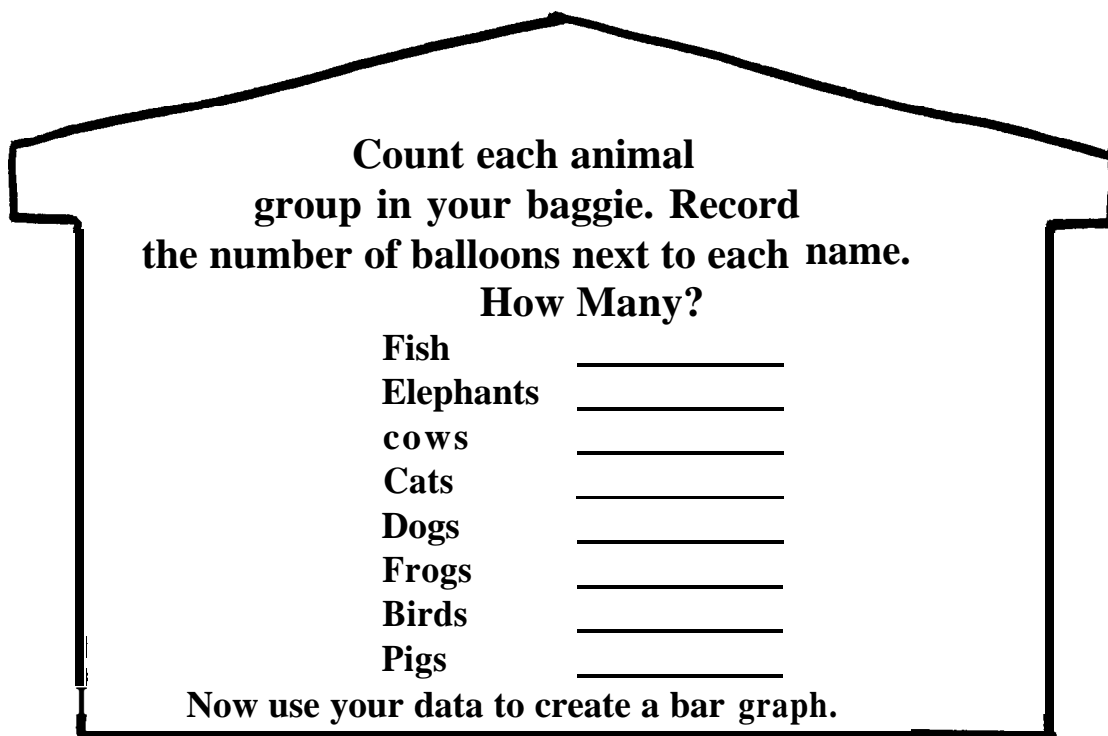


Directions: Run multiple copies of this page. Cut and sort into plastic baggies to create data packs. As you are making up the packs, put a different number and different variety of animals in each bag.

Name _____

SR1

Animal Balloon Data



Count each animal
group in your baggie. Record
the number of balloons next to each name.
How Many?

Fish	_____
Elephants	_____
cows	_____
Cats	_____
Dogs	_____
Frogs	_____
Birds	_____
Pigs	_____

Now use your data to create a bar graph.

Name _____

SR1

Animal Balloon Data

Count each animal
group in your baggie. Record
the number of balloons next to each name.
How Many?

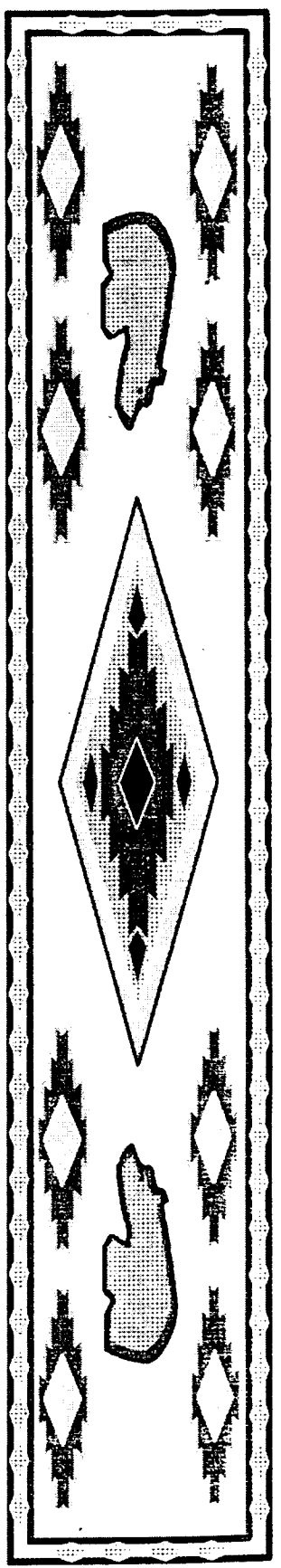
Fish	_____
Elephants	_____
cows	_____
Cats	_____
Dogs	_____
Frogs	_____
Birds	_____
Pigs	_____

Now use your data to create a bar graph.

Name

SR2

Use the back of this sheet to write at least 3 sentences explaining the data on your graph.

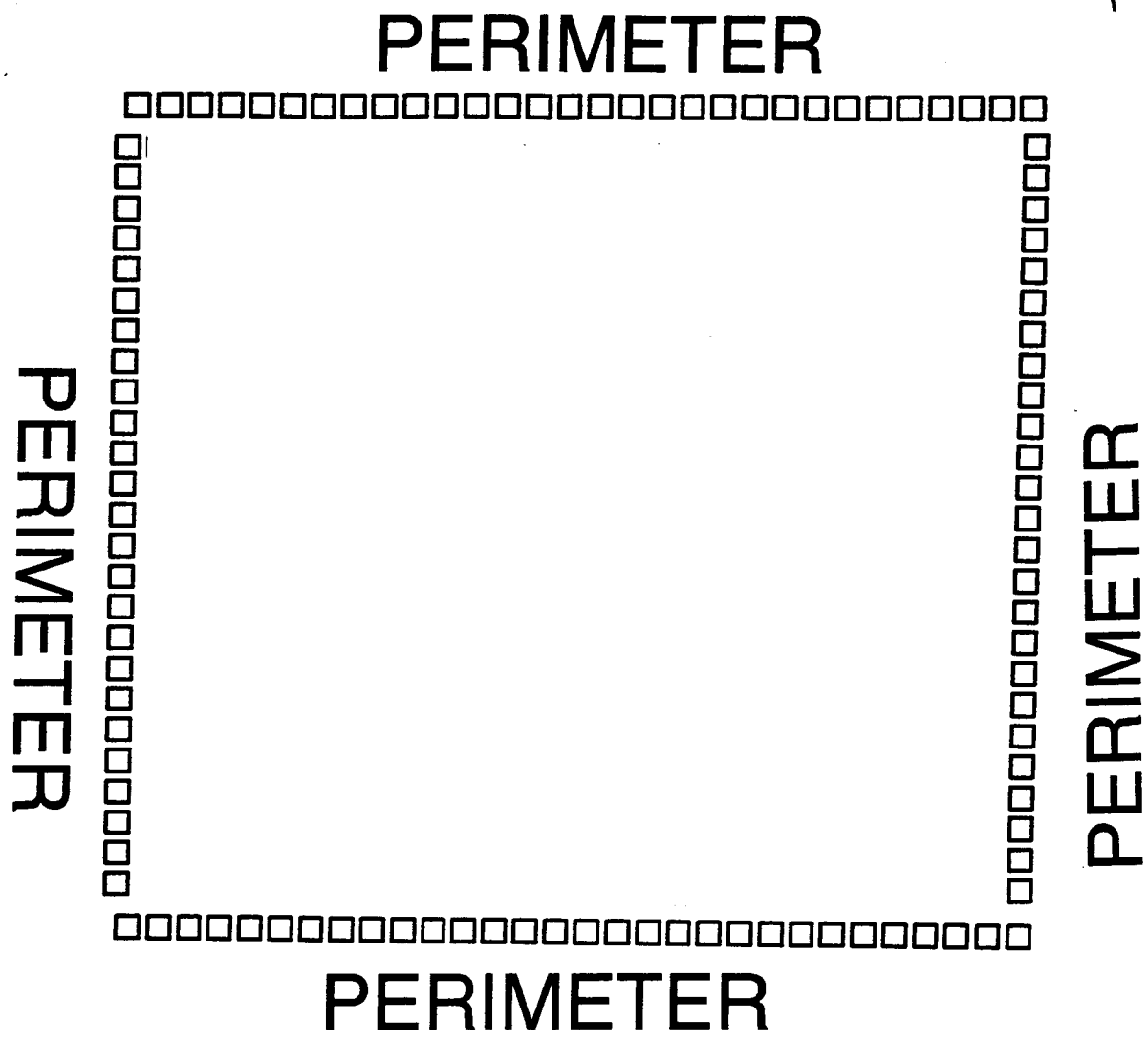


AREA

**AREA - The
inner region of
a figure or
space**

To find the area of a region count the
units *inside* the region.

TR3



PERIMETER- The
outer boundary
of a figure or
space

To find the **perimeter** of a region
count the units around the ***outside*** of
the region.

Name _____

SR3

Harvey Potter's Fields

1 	2 	3
4 	5 	6
7 	8 	9
10 	11 	12

Name_____

SR4

**Harvey Potter's Fields
Area and Perimeter Table**

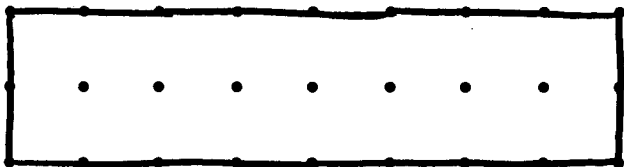
Fields		Perimeter- feet	Perimeter- yards		Area- square feet	Area-square yards
1						
2						
3						
4						
5						

Remember to show all your work in the space below and on the back of this page!

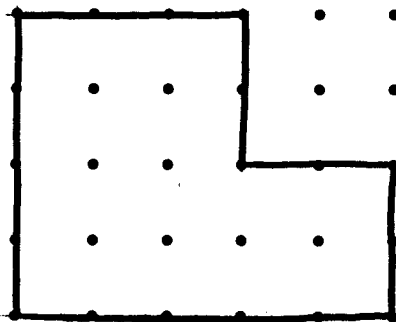
Harvey Potter's Fields

SR5

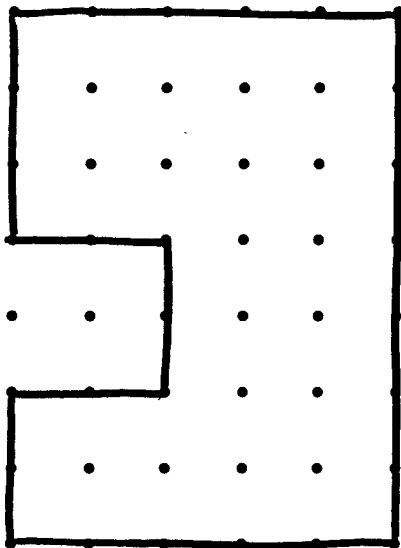
①



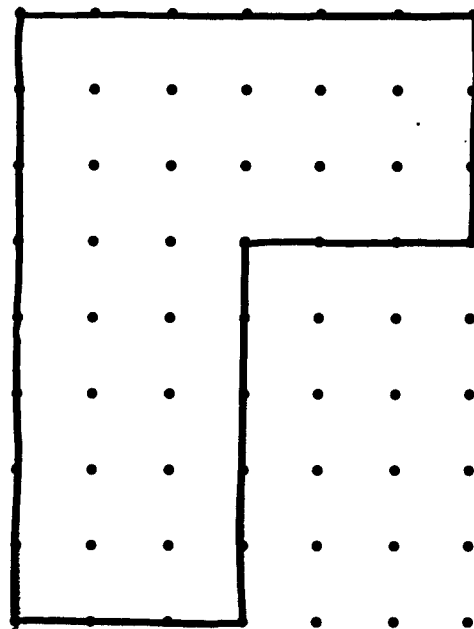
②



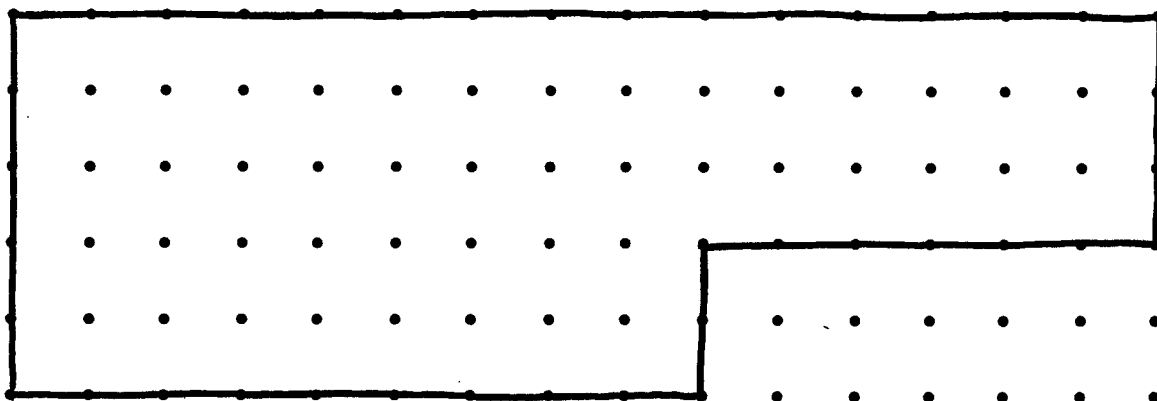
③



④



⑤

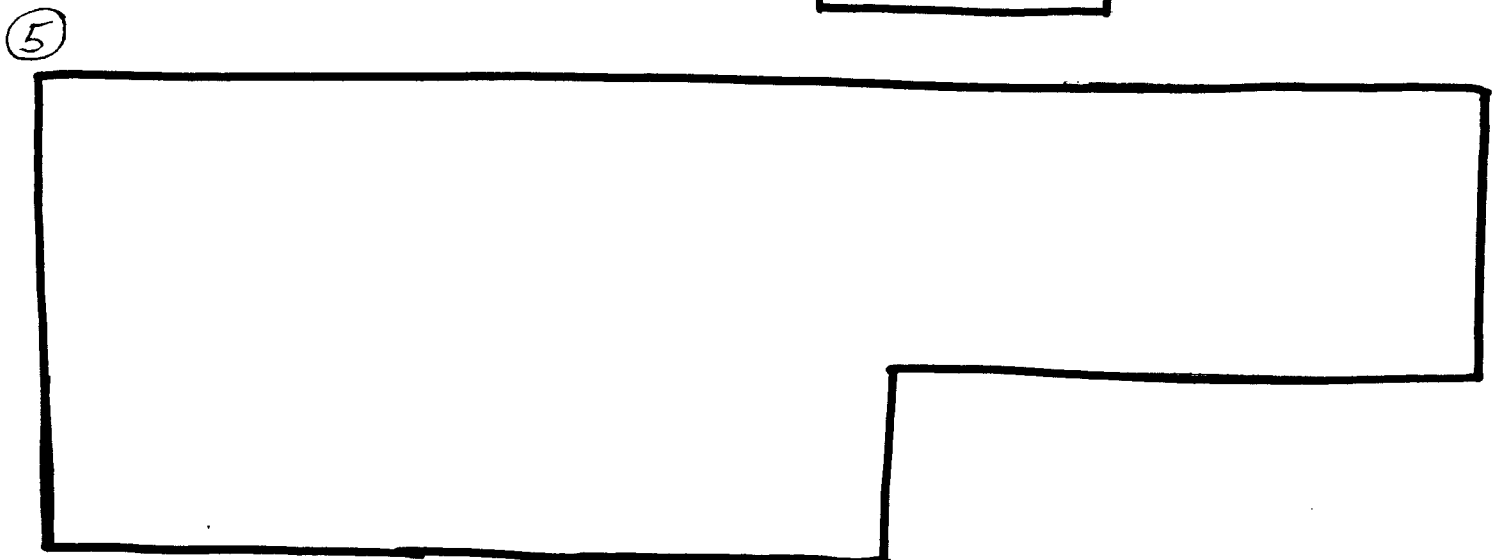
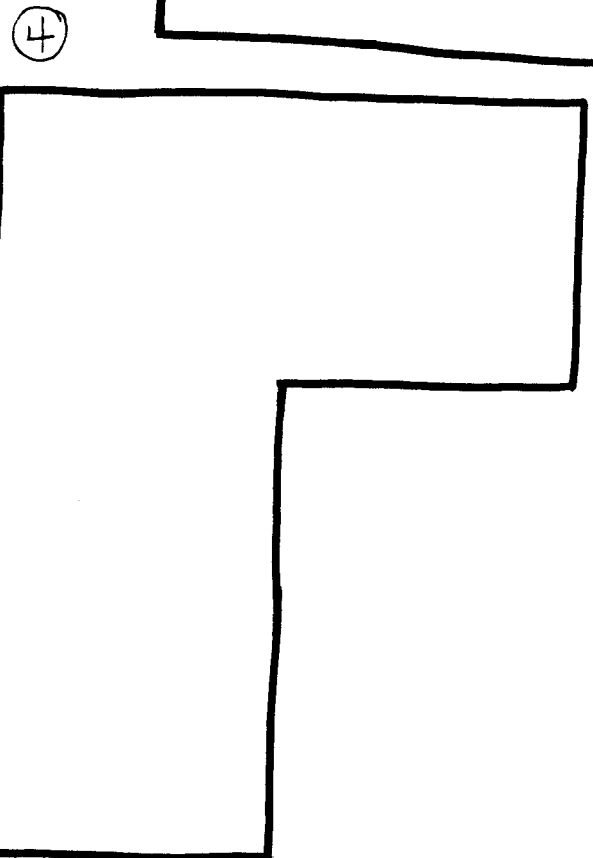
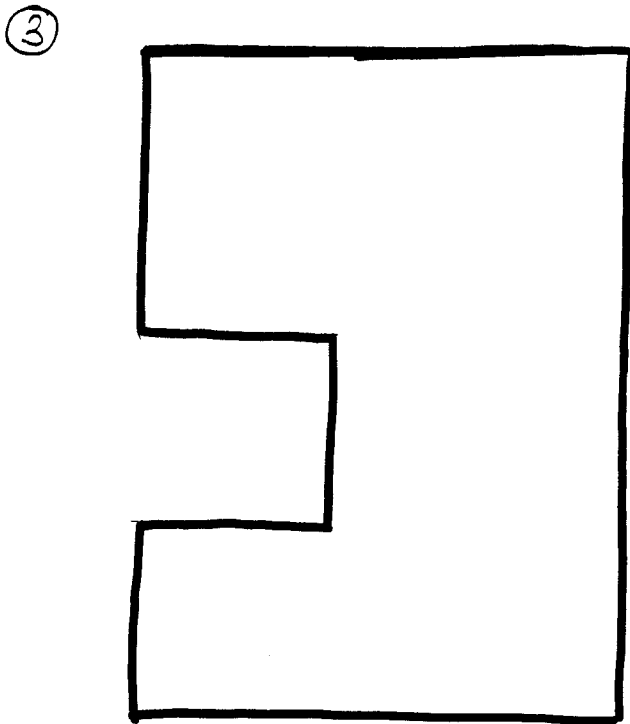
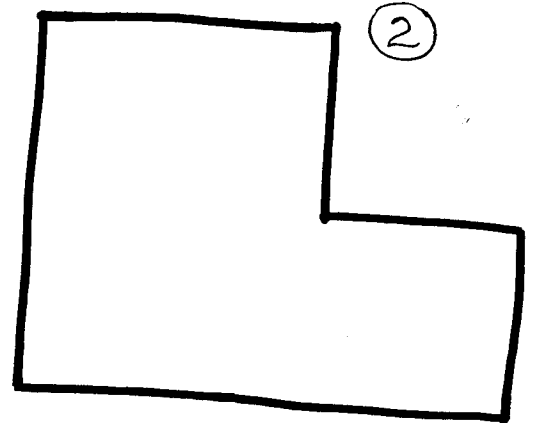
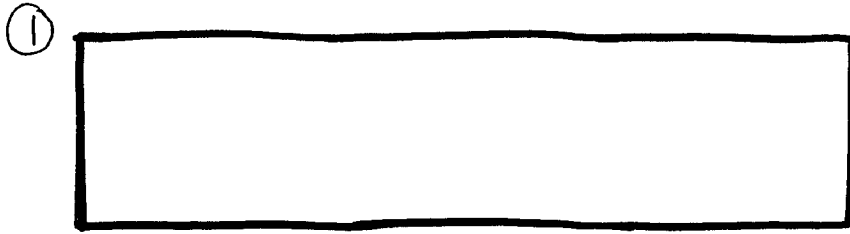


Scale: 1 line=1 yard

1 square unit=1 square yard

Harvey Potter's Fields

Extension sheet for using standard units. Have the students use an inch ruler and measure the perimeters and areas using the following scale: $1/2''=1$ yard, $1/2''$ squared=1 square yard.



Name _____

SR7

Best Buy Sheet-Harvey Potter's Fields

These prices are for field _____

Store	Price per yard or foot	Perimeter (from SR4)	Predict best buy(star one)	Actual price per foot
Hechinger's				
Home Depot				
Lowe's				

Use this space and the back of the paper to show your work.

Answer Sheet for Activities-Harvey Potter's Fields

SR3-Dot Paper

These answers are for the top half of the page. The bottom half will vary depending on the measurements you present to your class.

Shape	Perimeter (units)	Area (square units)
1	10 units	6 square units
2	12 units	7 square units
3	10 units	4 square units
4	10 units	5 square units
5	12 units	5 square units
6	14 units	8 square units

SR5 & SR6-Field shapes in standard and nonstandard units.

Shape	Perimeter-feet	Perimeter-yards	Area-square feet	Area-Square yards
1	60 feet	20 yards	48 sq. feet	16 sq. yards
2	54 feet	18 yards	48 sq. feet	16 sq. yards
3	84 feet	28 yards	93 sq. feet	31 sq. yards
4	84 feet	28 yards	99 sq. feet	33 sq. yards
5	120 feet	40 yards	189 sq. feet	63 sq. yards

SR7-Best Buy Sheet

Store	Price	1	2	3	4	5
Hechinger's	3'/\$5	\$90	\$90	\$140	\$140	\$200
Home Depot	1'/\$1.30	\$78	\$70.20	\$109.20	\$109.20	\$156
Lowe's	25 yds/\$75	\$75	\$75	\$150	\$150	\$150